Vascular Integrated Technical and Teamwork Assessment for Learning

VITTAL

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Overview

• Purpose of assessment
• Development and validation of the VITTAL assessment tool
• VITTAL & Milestones
• Using VITTAL to measure learning curve
Purpose of assessment

• Aid to learning through constructive feedback
• Determine the level of competence a trainee has reached
• Check that progress is being made through residency
• Ensure patient safety before a trainee performs a procedure unsupervised
• Certification of completion of training.
Criteria for effective assessment

Psychometric robustness

- Need to ensure assessments are:
  - Valid (or coherent)
  - Reliable (reproducible or consistent)
  - Feasible
  - Acceptable
  - Educational impact
  - Cost-effective

- Van der Vleuten’s utility index
  - Utility = Validity$^w$ x reliability$^w$ x acceptability$^w$ x educational impact$^w$ x cost$^w$
  - $W =$ weighted

Norcini et al, Med Teach. 2011;33(3):206-14
Framework for competency assessment

The assessment of clinical skills/competence/performance

Knowledge, skills & attitude

- Knows
- Knows how
- Shows how
- Does

Performance integrated into practice

Demonstration of learning

Interpretation/application of knowledge

Fact gathering

Professional authenticity

novice

expert

Miller GE. Acad Med 1990
Development and validation of the VITTAL assessment tool

- Brief survey APDVS members 2010
- Systematic review of published literature
  - Content validity
- Expert opinion (interviews)
  - Content validity
- Single institution
  - Inter-assessor reliability and construct validity
- Multi-institutional
  - Feasibility and generalizability
Brief survey APDVS members 2010

• Aim: Assess the current need for a systematic, validated operative competency assessment instrument

• Results:
  – Objective assessment of operative competence is a top priority – but currently lacking
  – Current assessment practices were deemed subjective
  – Assessment of operative competency performed at end of the rotation
  – Case logs do not accurately reflect operative competence
Systematic review of published literature

### Search Strategy

<table>
<thead>
<tr>
<th>Category A</th>
<th>‘competence’ OR ‘assessment$’ (MeSH) OR ‘skill$’ (MeSH) OR ‘training’ OR ‘performance’</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND</td>
<td></td>
</tr>
<tr>
<td>Category B</td>
<td>‘technical’ OR ‘non-technical’ OR ‘psychomotor’ OR ‘operative’ OR ‘simulation’</td>
</tr>
<tr>
<td>AND</td>
<td></td>
</tr>
<tr>
<td>Category C</td>
<td>‘Vascular surg*’ (MeSH) OR ‘Endovascular surg*’ (MeSH)</td>
</tr>
</tbody>
</table>

**LIMITS**
Publication date: 1980-Week 2, January 2013, English, Humans

Mitchell et al, JVS 2014 in press
Flow of articles in study

Potentially relevant reports identified by first search
\( n = 1,388 \)

Reports excluded after limits applied (English, 1980 – current, humans, duplicates)
\( n = 771 \)

Potentially relevant reports screened by title
\( n = 617 \)

Reports excluded on basis of title
\( n = 372 \)
- Not empirical data
- No assessment of vascular skill performed (excluding CVC)
- Reported on patient/procedural outcome or risk assessment

Potentially appropriate reports, abstract screened
\( n = 245 \)

Reports excluded on the basis of abstract
\( n = 194 \)
- Not empirical data
- No assessment of vascular skill performed (excluding CVC)
- Reported on patient/procedural outcome or risk assessment

Reports included for reading whole article
\( n = 65 \)

Reports excluded on the basis of full text
\( n = 21 \)
- Not empirical data
- No assessment of vascular skill performed (excluding CVC)
- Reported on patient/procedural outcome or risk assessment
- New references identified
\( n = 4 \)

Reports used for review
\( n = 48 \)

29 open vascular skills
19 endovascular skills
6 non-technical skill
1 team-work skills

41/48 (84%) simulated environment (SE)
Four (8%) operating room (OR)
Three both SE & OR

Mitchell et al, JVS 2014 in press
Current evaluative process of operative competence

Majority of methods currently favored by the GME community for assessment of operative competency do not fulfill the criteria for “effective assessment”

Norcini et al, Med Teach. 2011;33(3):206-14
Current evaluative process of operative competence

• Direct observations resident performance
  – No standard evaluation process/forms
    • Subjective, not consistent across residencies
  – At the completion of the trainees’ surgical rotation
    • Re-call bias, personality differences, trainer-trainee interactions, halo effect
Current evaluative process of operative competence

• Operative log data
  – Indicator of volume of operations performed during training
  – Does not capture:
    • Trainees’ understanding of the procedure and why it is being performed
    • Level of procedural participation
    • Quality of the procedural performance
Current evaluative process of operative competence

- **ABS examinations**
  - Only assess the lower levels of Miller’s assessment pyramid
  - Do not evaluate:
    - Ability of the trainee to perform a surgical procedure
    - Critical skills needed to safely conduct the operation from beginning to end
      - Crisis management, coping skills, communication, leadership, etc.
Current evaluative process of operative competence

- Majority of tools developed focus solely on technical skills performance
  - Checklists (CL) and global rating scales (GRS) most commonly used metrics
  - Others include:
    - Procedure-specific rating scales combining both CL and GRS metrics
    - Dexterity analysis systems
    - VR simulators
Objective technical skills assessment

Checklists
- Deconstruct task into key elements
- Assess whether key element has or has not (yes/no) been performed
- Discriminate between trainees of varying experience, not between higher level performers (ceiling effect)
- Useful for formative assessments (assessment for learning) where feedback provides insight for learning

Global rating scales
- Evaluate quality of performance of a task or a whole procedure
- Likert scoring system (1 = poor performance, 5 = excellent performance)
- Accurately discriminate between all levels of performers
- Useful for high stakes examinations (such as Board examinations) or summative assessment (assessment of learning)
Non-technical skills assessment

- Self-reported operative competence
- Stress levels

Deficiencies in teamwork, rather than simply poor technical ability, are the major contributors to adverse events in the OR.
Non-technical skills assessment

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  → Markers of coping ability

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• Non-technical and teamwork skills
  – Communication, decision-making, situational awareness, and leadership skills

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Non-technical skills assessment

• Self-reported operative competence
• Stress levels
  → Markers of coping ability
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Study findings critical to operative competency assessment

• **Self-assessments**
  – Not accurate for novice learners
  – With experience novice learners can learn to accurately reflect on their own performance

• **Assessment by non-surgeons**
  – Accurate in assessment of trainee performance when checklists used
  – Cannot accurately assess quality of a procedural performance (compared to expert)
Study findings critical to operative competency assessment

- **Assessment environment**
  - Simulated environment (SE)
    - Practical and accurate for deconstructed tasks
    - Context and realism is critical to performance
    - Procedural performance in SE does not necessarily translate to OR
  - True OR environment
    - Captures all components of the procedural performance (technical & non-technical)
    - Captures coping ability
Study findings critical to operative competency assessment

• **Post-hoc video assessments**
  – Time-saving and practical
  – Do not capture non-technical skills
    • Decision-making ability, situational awareness, leadership, etc.

• **Assessment must provide positive educational impact**
  – Expert feedback
  – Reflection on one’s own performance
Study findings critical to operative competency assessment

• Ideal assessment of operative competency:
  – Performed in the OR
  – Include assessment of both technical and non-technical skills
  – Provide immediate expert feedback on performance
  – Opportunity for self-reflection
Opinion of the Experts

• Surgical competence requires more than technical proficiency

• Criteria for operative competency:
  – Knowledge of vascular diseases, vascular anatomy and vascular procedures and their complications
  – Critical thinking, clinical judgment, decision making, leadership, communication, situational awareness, coping ability
  – Good patient outcomes
Opinion of the Experts

- Short assessment tool (1 pager)
- Simple to fill out
- Applicable to both open and endovascular skills
- One form for ALL procedures
VITTAL design

• GENERIC tool applicable to all procedures

• Procedural difficulty:
  – ● Basic ● Intermediate ● Complex

• Competencies:
  – Knowledge & judgment (pre-operative preparation)
  – Procedural & Technical Skills
  – Non-technical Skills

• Standard of performance:
  – 1 = Unsatisfactory → 5 = Competent or N = Not observed

• Global summary
  – Level at which resident performed for this procedure (Likert level 0-5)

• Debrief (Post-Operative Briefing)
Procedural difficulty

• **Basic**
  - Diabetic foot and wound management, amputations, basic arteriovenous [AV] fistula/graft, EW-code vascular exposures, varicose vein procedures, percutaneous vascular access, 1\textsuperscript{st} & 2\textsuperscript{nd} order catheterizations, inferior vena cava [IVC] filter placement

• **Intermediate**
  - Femoral-popliteal bypasses, extra-anatomic bypasses, thromboembolectomy, femoral endarterectomy, carotid endarterectomy, non-truncal vascular trauma, ilio-femoral PTA/stent, IVCF retrieval, infrarenal EVAR

• **Complex**
  - Open aortic surgery at all levels, mesenteric and renal interventions, infrageniculate intervention, re-operative vascular surgery, graft infections, carotid stent, complex EVAR/TEVAR/FEVAR
Knowledge & judgment (pre-operative preparation)

• **Essential data:**
  – Describes patient’s medical background, physical examination, laboratory studies and diagnostic studies pertinent to procedure.

• **Procedural rationale:**
  – Describes rationale for selecting this specific procedure (vs. alternative options) for this patient using meaningful data.

• **Procedural anatomy:**
  – Demonstrates knowledge of surgical anatomy & anatomic variants pertinent to this procedure.

• **Procedural understanding:**
  – Demonstrates knowledge of procedural steps & critical decision points for this operation and understands measure(s) for procedural success (patient-centered & best evidence).

• **Crisis management:**
  – Demonstrates knowledge of and treatment strategies for unexpected intraoperative findings, events or crises.
VITTAL competency domains

Procedural & Technical Skills

- **Procedural preparation:**
  - Ensures necessary imaging, instrumentation, equipment, devices, and medications are available; positions and drapes patient appropriately.

- **Basic surgical skills:**
  - Demonstrates knowledge and appropriate handling of instruments, respect for tissue, economy of motion, forward flow, and purposeful use of assistants.

- **Open vascular surgical skills:**
  - Safely, purposefully and expeditiously exposes, controls and closes the vasculature while employing hemostatic principles.

- **Endovascular skills:**
  - Controlled, efficient and precise wire, catheter, balloon and device positioning/deployment utilizing basic radiation safety principles.

- **Operative outcomes:**
  - Specifically assesses technical result/procedural endpoint(s) pertinent to goals of the procedure.
• **Situational awareness:**
  – Demonstrates ability to manage entire procedural environment & anticipate upcoming intraoperative needs and potential problems.

• **Teamwork:**
  – Leads time out, collaborates and coordinates with team members the safe operative care of the patient & provides a plan for the transition of care into the post-operative setting (hand-off).

• **Communication:**
  – Communicates & exchanges information appropriately with the patient (informed consent) & operative team regarding procedural needs & variations in the operative plan.

• **Coping-ability:**
  – Demonstrates effective coping strategies in response to intraoperative distractions, unexpected events &/or crises.

• **Leadership skills:**
  – Directs & coordinates the operative team while maintaining a resilient & supportive role.
Standard of performance

- **1 = Unsatisfactory:**
  - Requires significant & immediate improvement
- **3 = Sufficient:**
  - Achieves some, but not all goals; development required
- **5 = Competent:**
  - Capable of independent & unsupervised practice
- **N = Not observed**

- Descriptive summary for each domain provided on back of VITTAL sheet
Global Summary

Level at which resident performed for this procedure

- Level 0
  - Insufficient evidence observed to support a summary judgment
- Level 1
  - Unable to perform the procedure, or part observed, despite constant supervision
- Level 2
  - Able to perform the procedure, or part observed, with constant supervision
- Level 3
  - Able to perform the procedure, or part observed, with minimal supervision
- Level 4
  - Competent to perform the procedure independently
- Level 5
  - Able to competently teach and supervise other learners for this procedure
Debrief (Post-Operative Briefing)

Positive educational impact

Discuss procedural, technical and non-technical skill performance and provide feedback on strengths and specific areas for development.
Development and validation of the VITTAL assessment tool

Single institution

- **Reliability**
  - Inter-item reliability (internal consistency)
  - Test-retest (reliability across similar vs. longer time frame)
  - Inter-rater
    - Intraclass correlation coefficient (ICC) >0.70
    - Cronbach $\alpha > 0.70$

- **Construct validity**

- **Limitations:**
  - Single institution, Halo effect
Development and validation of the VITTAL assessment tool

Multi-institutional

• 25 programs

• Responses 12/25 (Σ 200 evaluations)
Development and validation of the VITTAL assessment tool

<table>
<thead>
<tr>
<th>Procedural difficulty</th>
<th># responses</th>
<th>Minimum time for completion</th>
<th>Maximum time for completion</th>
<th>Average time for completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>63/69</td>
<td>1</td>
<td>10</td>
<td>5.8</td>
</tr>
<tr>
<td>Intermediate</td>
<td>67/84</td>
<td>1</td>
<td>15</td>
<td>3.4</td>
</tr>
<tr>
<td>Complex</td>
<td>37/47</td>
<td>1</td>
<td>10</td>
<td>3.9</td>
</tr>
</tbody>
</table>

97 open, 94 endovascular, 9 hybrid

Time taken to complete initial evaluations took the longest with times there after in the 1-3 minute range
## Development and validation of the VITTAL assessment tool

Place an 'X' in the box that best fits your answer to indicate a response.

<table>
<thead>
<tr>
<th>Section</th>
<th>Questions</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge &amp; judgment</td>
<td>Captures the key elements required for assessment of operative competence for this domain?</td>
<td></td>
<td></td>
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<td>4</td>
<td>155</td>
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<tr>
<td></td>
<td>Likert anchors discriminate between levels of competency</td>
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<tr>
<td></td>
<td>Was simple to fill out?</td>
<td></td>
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<td>Captures the key elements required for assessment of operative competence for this domain?</td>
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<td>Captures the key elements required for assessment of operative competence for this domain?</td>
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<td></td>
<td>1</td>
<td>142</td>
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</table>
Challenge(s) encountered with completing VITTAL include:

- Lack of familiarity
- Challenging to find the time to debrief
- Shade crisis management box as it is not applicable for all cases
- Non-technical skills may be altered by the quality of OR assistants etc that influence the “smoothness” of the operation
Development and validation of the VITTAL assessment tool

Recommendation(s) for enhancing the tool include:

• Make available on line
• Make it available on an app
• Global summary:
  – Make it simple- do I recommend that this trainee do this procedure in practice: Y/N
  – Make it P/F/P with excellence
• Make it 1 page
Development and validation of the VITTAL assessment tool

Recommendation(s) for enhancing the tool include:

• Should be more case specific
• Should have separate form for endo cases
• Do not ask about # prior cases performed
• Would not recommend completing this for all procedures
• Not every thing is applicable, recommend including N/A alongside not observed
Recommendation(s) for enhancing the tool include:

- Consider 4-point Likert score for “std of performance” so that 3 is not always chosen
- Provide area for residents to insert their comments
General comments

- Best done immediately after the procedure
- I like the tool, it takes time getting used to it
- Gets easier/quicker with time
- Labor intensive if done for every case
- Diminishing returns, becomes pointless
- Is more useful for junior trainees who want & need more feedback
Using VITTAL to measure learning curve

Cumulative Sum Control Chart (CUSUM)

- Delineate # operations or range of operations required to reach “competency”
  - # operations required to “turn the learning curve”